

**Justification  
for  
Proposed State Of California  
Title 8  
Group V  
Elevator Safety Orders**

The use of unsafe or defective conveyances imposes a substantial probability of serious and preventable injury to employees and the public. The prevention of these injuries and protection of employees and the public from unsafe conditions is in the best interest of the people of this state.

***- California Labor Code §7300(b)***

## Fatality Rates (per 10,000 workers) in Selected Building Trades

*The elevator worker is frequently exposed to deadly falling, crushing, shearing and electrical hazards.*

*Designs that increase the frequency of exposure to these hazards increase the probability for injuries and fatalities.*

***The design of the elevator is critically important to the elevator worker's occupational safety and health.***

The table below shows the expected fatality rate for each trade based upon 10,000 workers employed.

Trade	Workers Employed in 2012	Fatalities per 10,000 Workers <sup>1</sup>
Iron Workers	58,100	2.926
<b>Elevator Workers</b>	<b>19,700</b>	<b>2.538</b>
Electricians	583,500	1.097
Brickmasons	85,100	1.058
Construction Laborers	1,284,600	0.895
Drywallers	114,100	0.789
Carpenters	901,200	0.621
Plumbers/Pipefitters	386,900	0.620
Construction Equipment Operators	409,700	0.488
Sheet Metal Workers	142,300	0.422
Cement Masons	144,300	0.347

Information used in this table was supplied by the U.S. Department of Labor, Bureau of Labor Statistics. See the following links:

<http://www.bls.gov/ooh/construction-and-extraction/>

<http://data.bls.gov/gqt/InitialPage>

---

<sup>1</sup> Based upon a three year average of BLS fatality statistics from 2011 through 2013.

**U.S. Bureau of Labor Statistics**  
**Nonfatal Occupational Injuries and Illnesses**  
**Elevator Installers and Repairers (code 474021)**

<b>Year</b>	<b>Total Number of Serious Injuries and Illnesses</b>	<b>Contacting Objects or Equipment</b>	<b>Falls</b>	<b>All Other Exposures</b> (includes injuries caused by overexertion – sprains, strains, etc.)
<b>2009</b>	<b>180</b>	<b>61%</b>	<b>17%</b>	<b>22%</b>
<b>2010</b>	<b>130</b>	<b>46%</b>	<b>0%</b>	<b>54%</b>
<b>2011</b>	<b>160</b>	<b>31%</b>	<b>13%</b>	<b>56%</b>
<b>2012</b>	<b>300</b>	<b>80%</b>	<b>7%</b>	<b>13%</b>
<b>2013</b>	<b>320</b>	<b>50%</b>	<b>25%</b>	<b>25%</b>

Elevator Workers are exposed to fall hazards when working in elevator hoistways.



Views looking up the hoistways



# PRIMARY ELEVATOR SAFETY CONCERNS

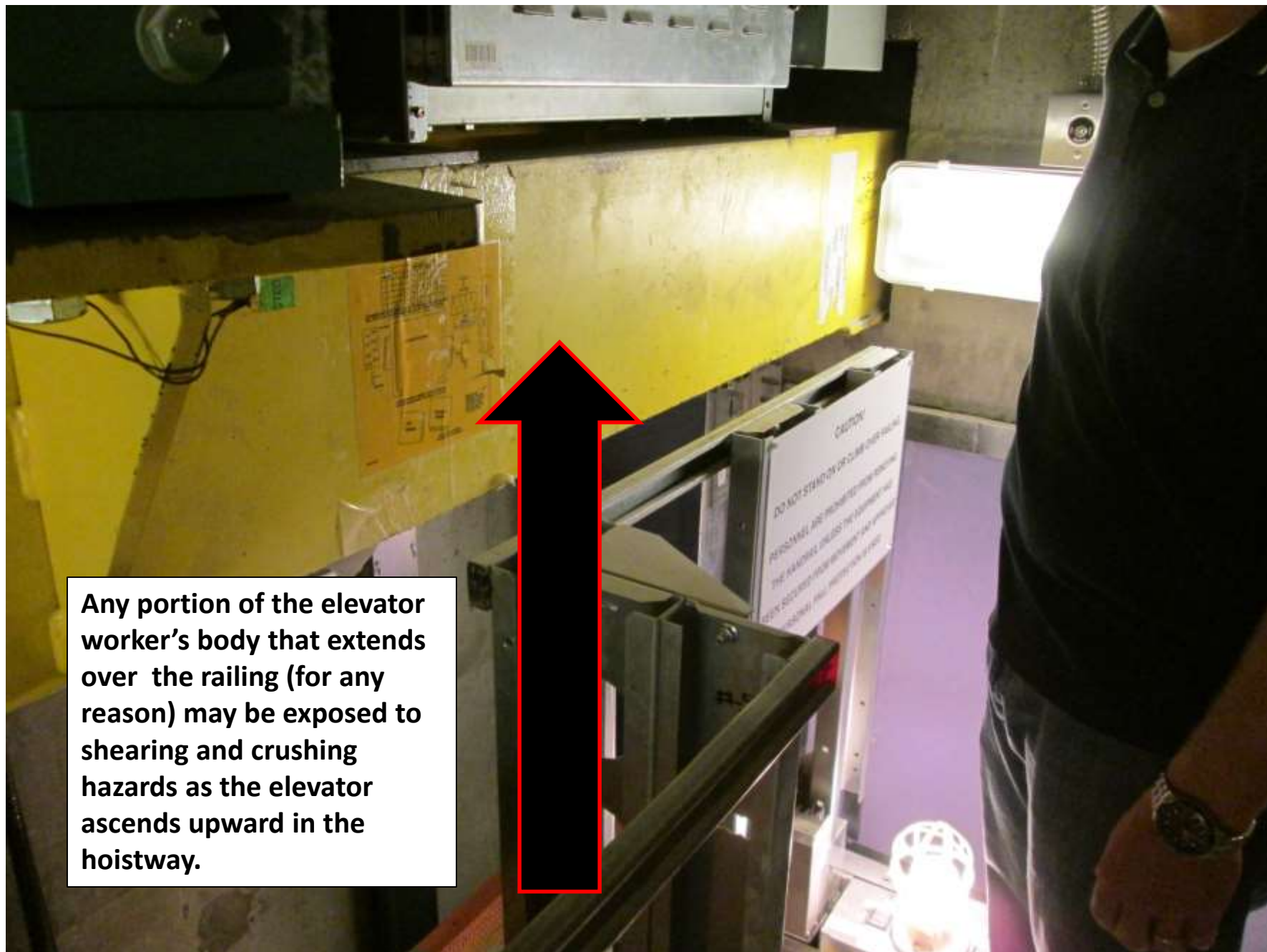
- Car top railings create new **shearing and crushing hazards** for elevator workers.
- Some new elevator designs **do not provide safe access** to elevator equipment located in the hoistway. Inaccessible equipment promotes risky behavior. Inaccessible equipment can not be examined and maintained.
- Controllers located in publicly accessible spaces expose elevator workers and the general public to **electrical hazards**.
- Controllers located in the hoistway expose elevator workers to **electrical and mechanical hazards**. Controllers hidden behind elevator lobby walls expose building personnel to **electrical hazards**.
- Some new elevator designs require elevator workers to do their work in **confined spaces**. If mechanical and electrical hazards are present in that space, it may become a **permit-required confined space**.
- Some of the design and installation rules in the current model consensus standard are **less protective than the minimum safety standards** contained in the Title 8 General Industry Safety Orders **which apply to all places of employment**.

# Car Top Railing Clearance

The current model consensus standard allows for elevator designs that provide.....

- **no minimum horizontal clearance protection** from shearing and crushing hazards for a worker's body as the elevator ascends the hoistway.
- **inadequate protection** from crushing hazards for a workers body at the extreme limit of travel in the hoistway.

**Any portion of the elevator worker's body that extends over the railing (for any reason) may be exposed to shearing and crushing hazards as the elevator ascends upward in the hoistway.**









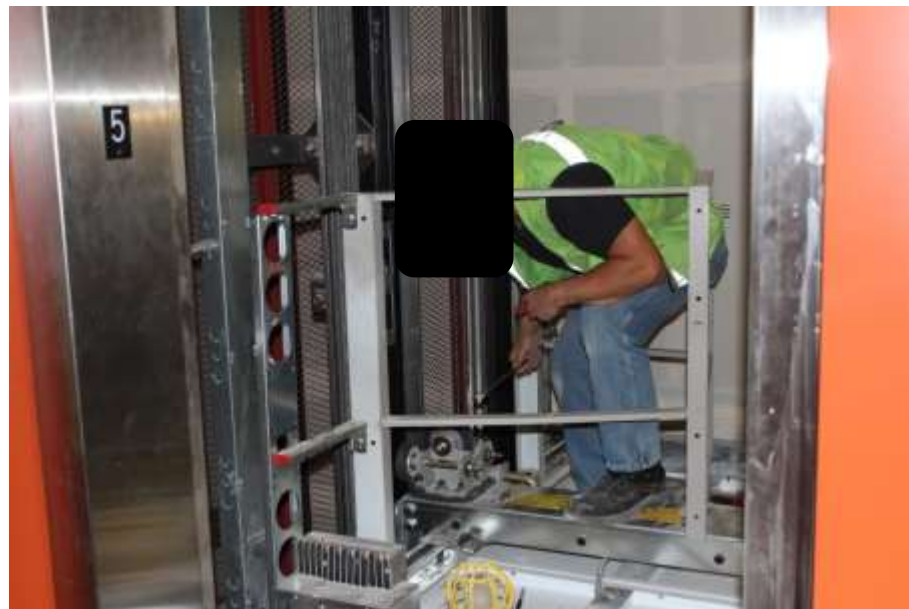
# Recent changes to Car Top Railing Placement and Minimum Vertical Clearances

The two pictures below are of the same elevator shot from different perspectives and elevations.



In order to accommodate space saving MRL designs, the current model consensus standard allows the car top railings (fall protection) to be placed anywhere on the car top. The vertical clearance requirement outside the railing was **reduced from 43 inches to 4 inches**.

When a DOSH elevator inspector arrived at the jobsite to conduct the initial inspection for this elevator, he found the elevator mechanic adjusting the car roller guides in the space directly below the machine (see above). The model consensus standard only requires **4 inches of vertical clearance** in this space.



**As clearly illustrated here, any elevator worker leaning or reaching over the railing, or working in the space outside the railing, would be subject to a serious shearing and crushing hazard if the elevator unexpectedly moved upward to within 4 vertical inches of the car top at the extreme limit of travel.**


# Group V Elevator Safety Order Proposals to Address Car Top Railing Problems:

- ✓ 12 inch horizontal clearance between the car top railing and any unprotected or unguarded fixed obstruction in the hoistway (if necessary, the car top railing may be inset from the perimeter of the car top a maximum of 12 inches to accomplish this clearance).
- ✓ 12 inches of vertical clearance between the car top railing and any fixed obstructions overhead at the extreme limit of travel.
- ✓ 43 inches of vertical clearance for all areas of the car top at the extreme limit of travel (including areas outside the railing).

# Access to Equipment and Worker Safety

The current model consensus standard allows critical equipment to be installed at the top of the hoistway, but does not adequately require that safe access be provided to that equipment for maintenance and inspection. If safe access to critical equipment is not provided, it may promote the following:

- **Risky behavior.** Elevator workers may be encouraged to climb on the car top railings and other structural members in the hoistway to gain access to the equipment.
- **Critical equipment may not be examined and maintained** which could put the riding public at risk.

A photograph showing the interior of an elevator shaft. A yellow metal frame supports the driving machine, which is located above the roof line. The machine includes a motor, drive sheave, brakes, brake contacts, and a tachometer. The shaft walls are green with white trim. A black metal beam and a steel cable are visible in the foreground. A timestamp in the bottom right corner reads "AM 7:09 MAR/21/2013".

Elevator driving machine (including motor, drive sheave, brakes, brake contacts, tachometer, etc.) above the roof line at the top of the hoistway with no provisions for safe access.

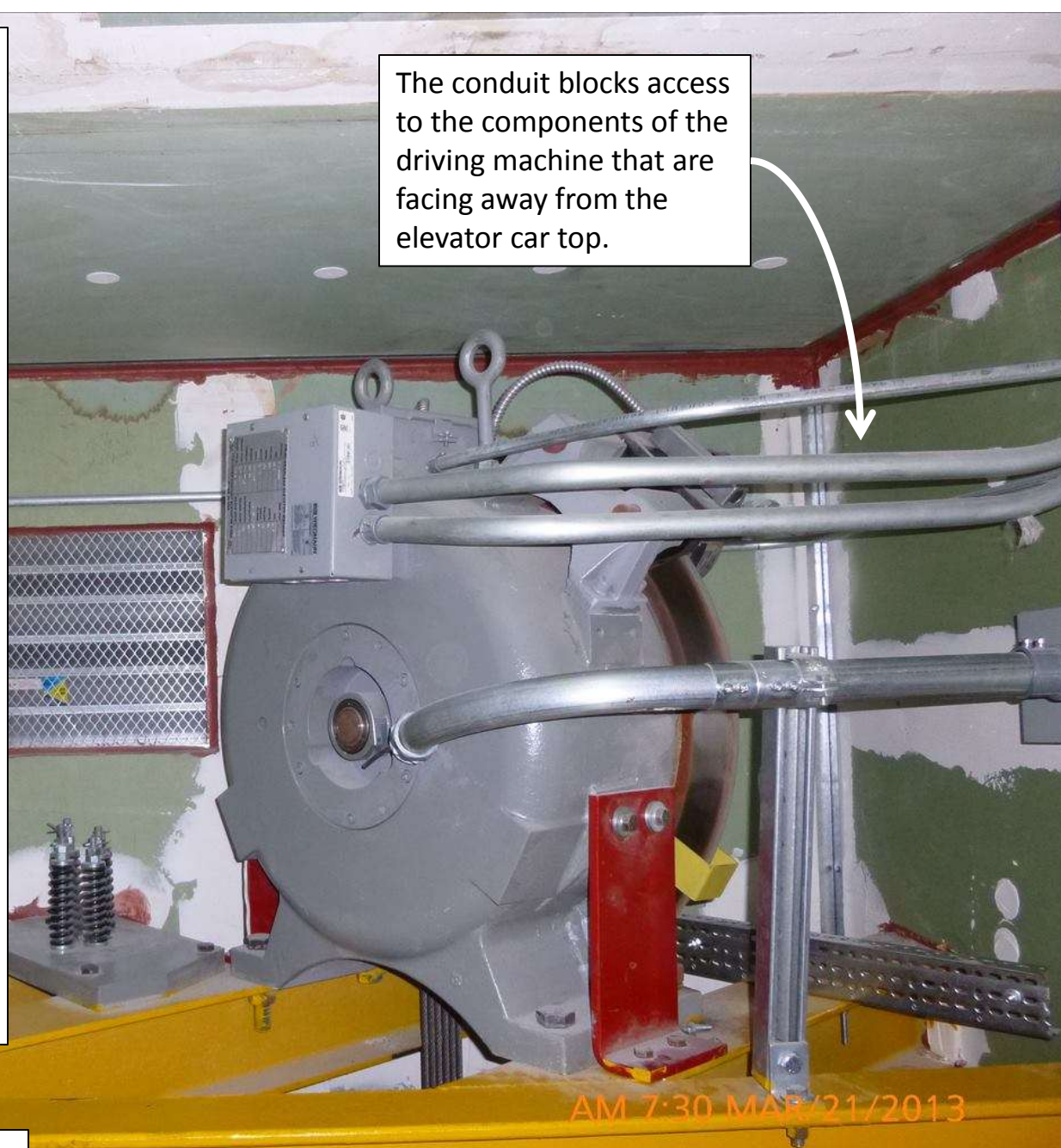
AM 7:09 MAR/21/2013



Without a floor or a door allowing access from outside the hoistway, this sort of configuration, which is allowed by the current model consensus standard, does not provide safe access for routine maintenance and inspection of this equipment.

Faced with such a configuration, an elevator worker would likely be forced to use a portable ladder to climb off the car top and stand on these yellow beams at the top of the hoistway to maintain or inspect this equipment, thereby creating a serious fall risk.

The conduit blocks access to the components of the driving machine that are facing away from the elevator car top.



Driving machine from previous slide.



Inaccessible  
MRL driving  
machine,  
electrical  
equipment and  
governor.











Because this installation configuration does not provide safe access to critical components of the driving machine, this elevator worker attempted to access the driving machine brakes by standing on top of the 43 inch high car top railing thus bypassing the primary means of fall protection mandated by the current model consensus standard.

This exposes the worker to a serious fall hazard, in this case approximately 90 feet, which is the most common cause of fatalities in a hoistway.








Many MRL designs incorporate “off the shelf” permanent magnet gearless machines that are easily maintained and inspected in a machine room, but are often not installed in a manner to provide safe access to critical components when installed in a hoistway.

In this installation, also pictured in the previous slide, the machine is rotated 180° away from the elevator car top to save horizontal hoistway space making the drive sheave and brakes inaccessible for necessary maintenance and inspection.



Another example of the drive sheave and brakes of a driving machine buried deep into the top corner of the hoistway making them effectively impossible to access for routine maintenance or inspection.



The inaccessible elevator equipment for the MRL installation pictured in the previous 4 slides was located in this “doghouse” area that extends above the roof line of the building.

**The next 3 slides show how safe access to this equipment was provided by simple modifications to this “doghouse” area.**



The existing “doghouse”  
was extended vertically  
and turned into an  
accessible machine room.

AM 8:01 APR/20/2013





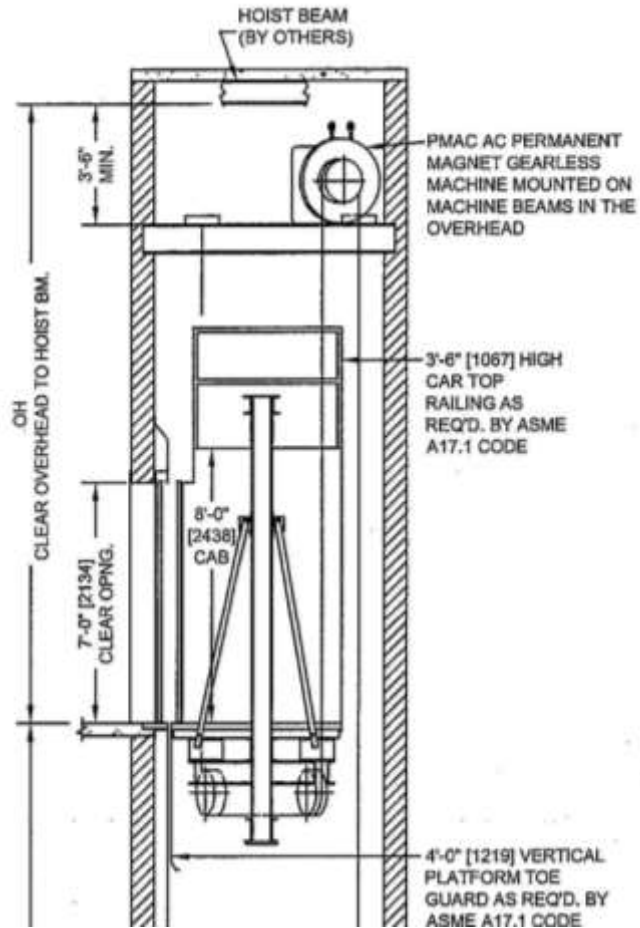
AM 8:02 APR/29/2013



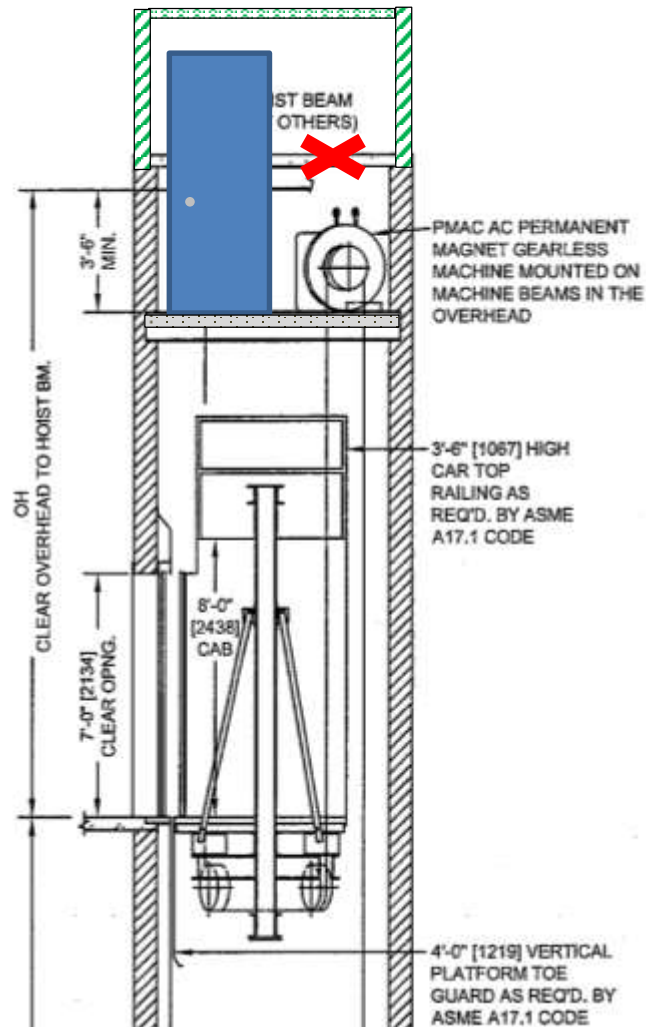
As modified, all components of the elevator equipment in this installation are now safely accessible in a room. Unlike the original configuration, this room is **not a confined space**.



AM 8:04 APR/23/2013




Inaccessible  
equipment which  
must be  
maintained from  
the car top in a  
confined space.



Accessible  
equipment  
maintained in a  
dedicated room  
that is not a  
confined space.

# Confined Space



State of California  
Department of Industrial Relations


Press Room | Contact DIR | CA.gov


Search

• This Site • California

Home | Labor Law | Cal/OSHA - Safety & Health | Workers' Comp | Self Insurance | Apprenticeship | Director's Office | Boards

Cal/OSHA


 **Confined Space Emphasis Program**



**What is a confined space in general industry?**

Any type of space that:

- Is large enough and configured such that an employee can bodily enter and perform work.
- Has limited openings for entry and exit.
- Is not designed for continuous employee occupancy.




**What is a permit-required confined space in general industry?**

(General Industry is covered by [Title 8, Section 5157.](#))


Any type of space that:

- • Has all three of the characteristics above, plus one or more of the following:
  - Has a hazardous atmosphere – or has the potential for a hazardous atmosphere – including too little or too much oxygen, and/or the presence of toxic or explosive gases or vapors (such as hydrogen sulfide or methane).
  - Has a material that can – or potentially will – engulf an employee, such as grain, sand or sugar.
  - Has an internal configuration (such as floors that slope downwards) that can – or potentially will – trap or asphyxiate employees.
- • Has any other recognized serious safety or health hazard, such as machinery with moving parts, sources of electrical shocks, steam (burn hazard), or liquids (drowning and fire hazards).

Cal/OSHA

 **Quick Links**

- [File a workplace safety complaint](#)
- [Learn about worker rights](#)
- [Obtain a free consultation](#)

 **Cal/OSHA Branches & Units**

**Branches**

- [Enforcement](#)
- [Consultation](#)

**Units**

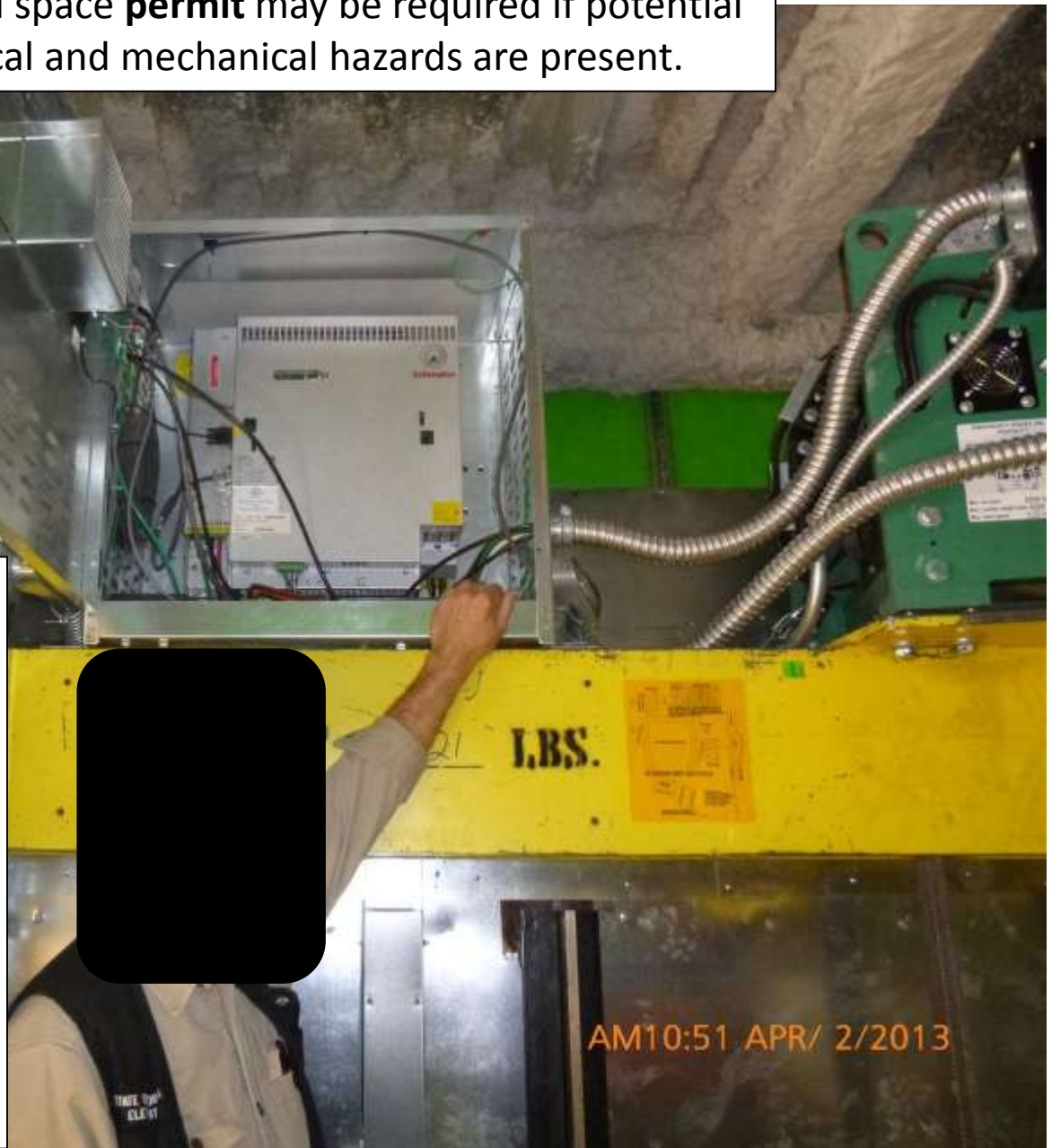
- [Amusement Ride and Tramway](#)
- [Asbestos and Carcinogen](#)
- [Crane](#)
- [Elevator](#)
- [Heat and Agriculture Program](#)
- [High Hazard](#)
- [Labor Enforcement Task Force](#)
- [Legal and BOI](#)



A confined space **permit** may be required if potential electrical and mechanical hazards are present.

Confined Space Test:

- ✓ #1) Is the space large enough and configured such that an employee can bodily enter and perform work?
- ✓ #3) Is the space not designed for continuous employee occupancy?





Confined Space Test:

- ✓ #2) Does the space have limited openings for entry and exit?





MRL  
Equipment

Top Floor of the Building

# Group V Elevator Safety Order Proposals to Address Safe Access to Equipment and Confined Space Problems:

- ✓ Establishes maximum reach requirements (based upon anthropometric data) to components of driving machines, motors, brakes and governors.
- ✓ Components of driving machines, motors, brakes and governors must be reachable when the elevator car top is level with the top landing.

# Controllers in Public Spaces

Under the current model consensus standard, elevator controllers can be installed in public spaces causing potential risks to both elevator workers and members of the general public.

- Controllers installed in public spaces may expose elevator workers and the general public to **electrical hazards**.
- When the approved controller cabinet cover is removed, live parts may be exposed. Elevator workers and the general public must be protected from **accidental contact with energized parts** (see §110.27 of the California Electric Code and §2340.17 of the Title 8 Low-Voltage Electrical Safety Orders).
- In some configurations, workers accessing controllers installed in public spaces may block code required egress routes from the building.



Elevator worker troubleshooting live controller directly in front of the entrance to the elevator car.

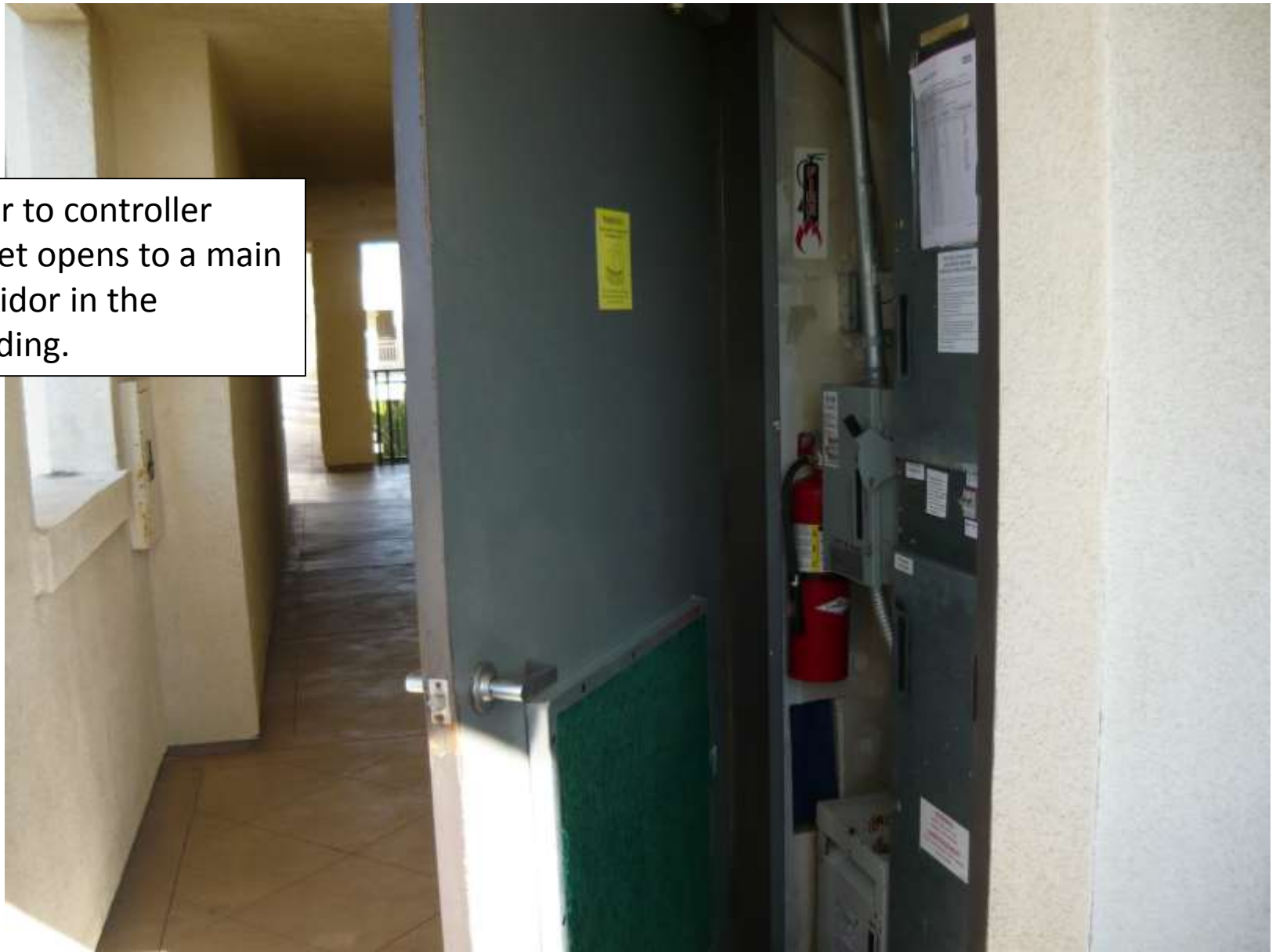




Door to controller closet blocks emergency egress from the building.



Door to controller closet opens to a main corridor in the building.





Controller closet in a stairwell exit of a transit building.



Controller closet on the roof of a building and potentially exposed to rain.

The closet has insufficient electrical clearances for an elevator worker to work on exposed live parts with the closet doors closed.



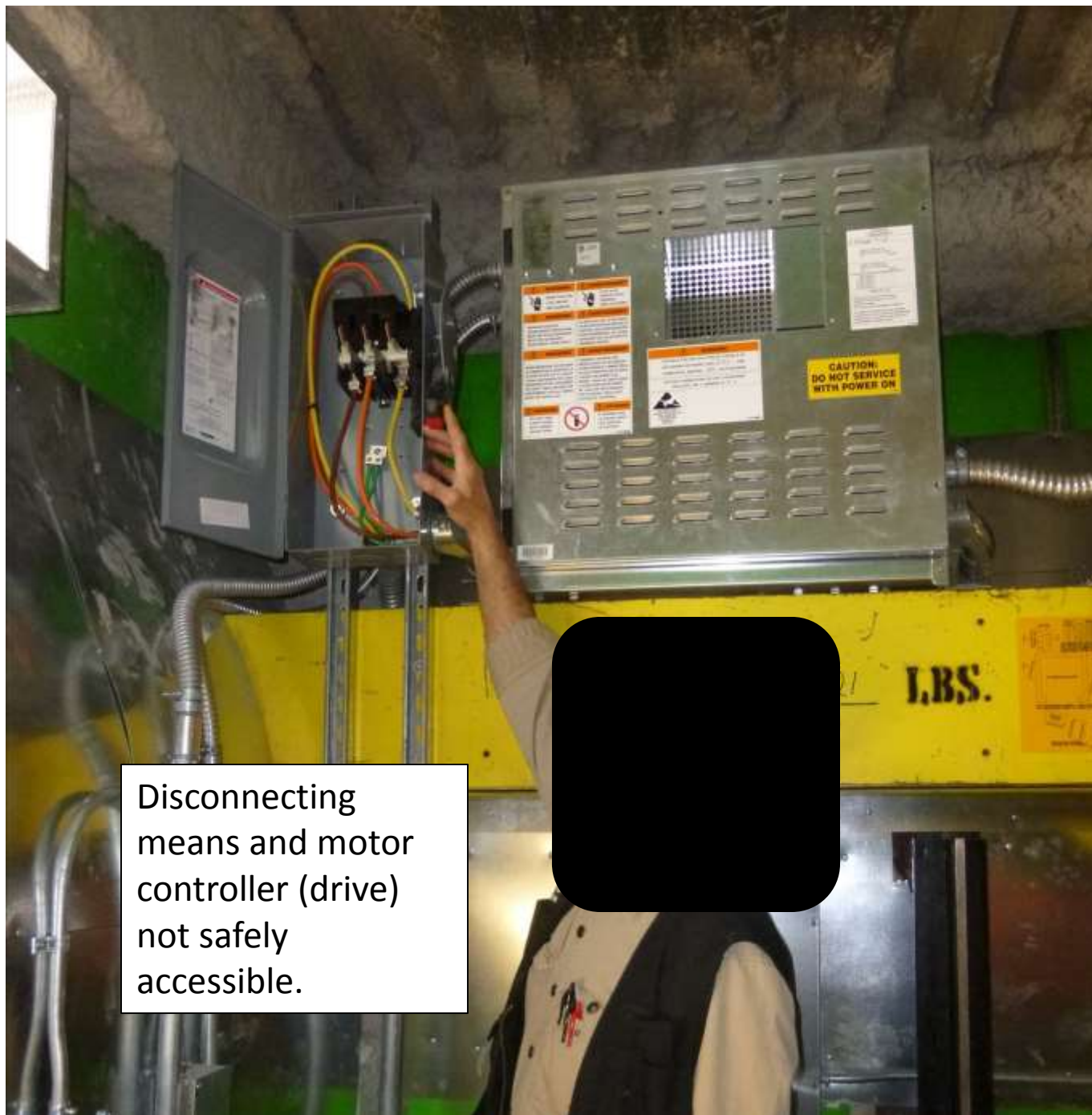
# Group V Elevator Safety Order Proposal For Controllers in Public Spaces:

- ✓ Elevator motor and motion controllers must be installed in a room of sufficient size so that an elevator worker can work on exposed live parts with the door to the room in the closed and locked position.

# Controllers in the Hoistway

Under the current model consensus standard, controller equipment located in the elevator hoistway.....

- may **not be safely and readily accessible** for elevator workers and emergency personnel as required by §110.26 of the California Electric Code and §2340.16(a) of the Title 8 Low-Voltage Electrical Safety Orders.
- expose elevator workers to **reduced or eliminated electrical clearances** (see §110.26(A) of the California Electric Code and §2340.16(b) of the Title 8 Low-Voltage Electrical Safety Orders).
- expose elevator workers who may be troubleshooting or adjusting the elevator controller to **mechanical hazards** associated with unintentional movement of the elevator.







Elevator worker's hand may contact hidden exposed live parts (see next slide).

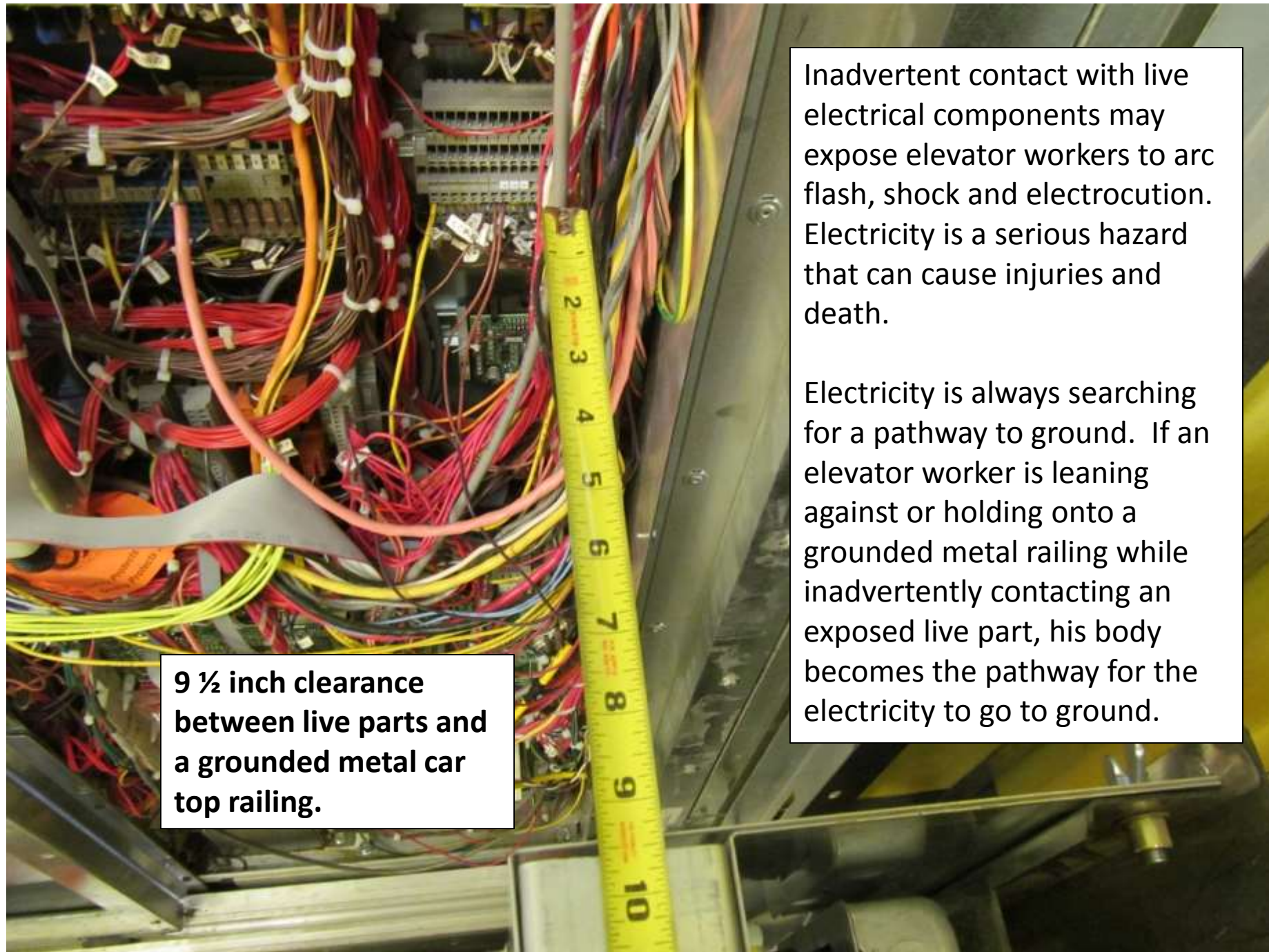
Motor Controller (drive) not safely accessible.



Incoming 480V – 3 Phase  
Power Supply.

AM11:03 APR/ 2/2013





**9 ½ inch clearance  
between live parts and  
a grounded metal car  
top railing.**

Inadvertent contact with live electrical components may expose elevator workers to arc flash, shock and electrocution. Electricity is a serious hazard that can cause injuries and death.

Electricity is always searching for a pathway to ground. If an elevator worker is leaning against or holding onto a grounded metal railing while inadvertently contacting an exposed live part, his body becomes the pathway for the electricity to go to ground.

During construction, the elevator installer wrote this message on the lobby wall to alert construction drywall installers to the otherwise hidden hazard of potential contact with electrical equipment on the other side of the wall.

When the building is completed, however, building engineers and maintenance workers will have no warning of this hidden electrical hazard.





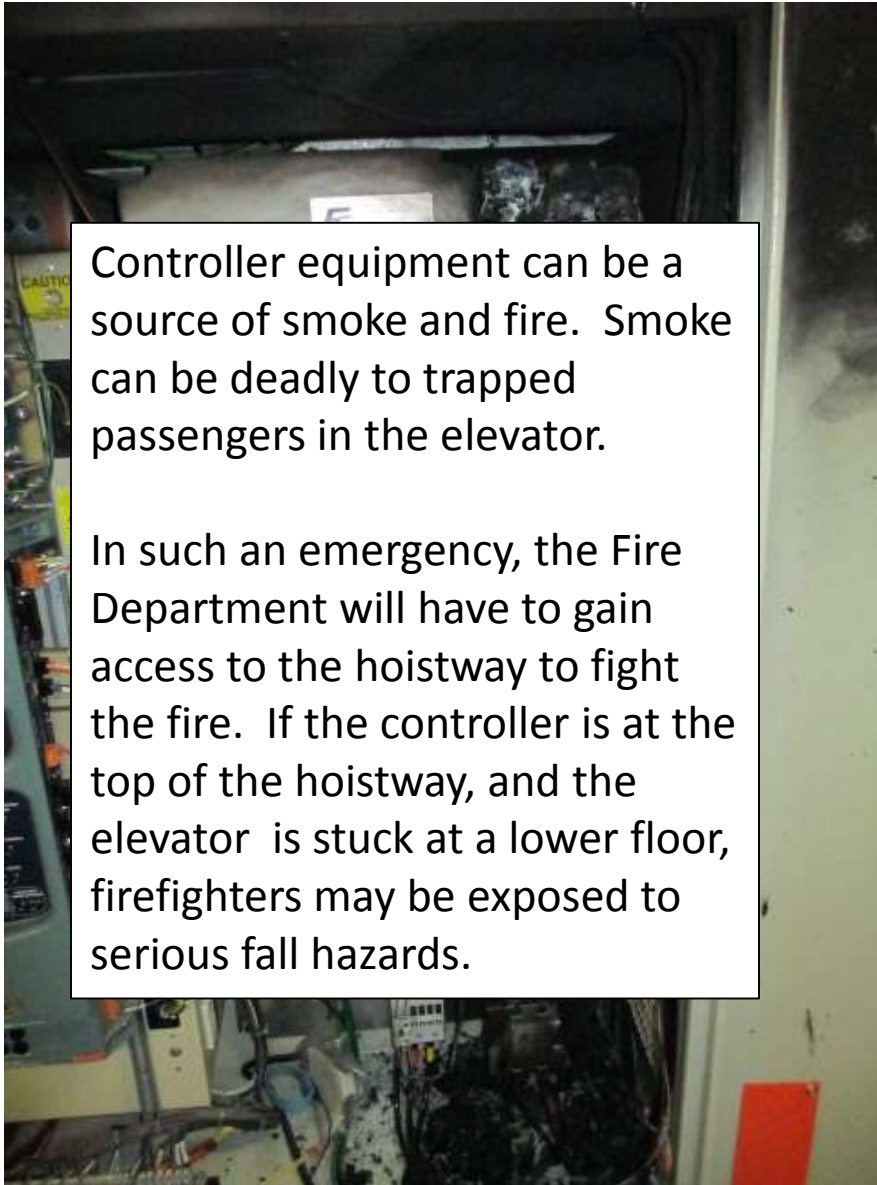
Drywall screw driven from the lobby through the back of a controller mounted inside the hoistway wall. Screw just misses an electrical transformer.



Drywall screw just  
missing a 3 phase  
terminal block.





A photograph of an elevator control room. The room is dimly lit, with a control panel visible on the left side. A text box is overlaid on the image, containing two paragraphs of text. The background shows various cables and equipment.

Controller equipment can be a source of smoke and fire. Smoke can be deadly to trapped passengers in the elevator.

In such an emergency, the Fire Department will have to gain access to the hoistway to fight the fire. If the controller is at the top of the hoistway, and the elevator is stuck at a lower floor, firefighters may be exposed to serious fall hazards.



# Group V Elevator Safety Order Proposal

## For Controllers in Hoistways:

- ✓ Elevator motor and motion controllers must be installed in a room of sufficient size so that an elevator worker can work on exposed live parts with the door to the room in the closed and locked position.



# New Designs and Technologies

**“The cumulative effect of the unique requirements being proposed by DOSH will be to prohibit California building owners and businesses from installing the latest elevator *technologies*. This includes *energy efficient designs and technologies*.....”**

**“These DOSH restrictions will also hamper the ability of private building owners and other businesses to meet the Governor’s *“green building”* goals.”**

**“.....force private and public sector purchasers of conveyances to *buy technology that is over 15 years old* moving California away from its role as a leader in the development and application of new *designs and technology*.”**

- Quotations from a letter to the Director of DIR commenting on the proposed Group V ESOs (emphasis added)

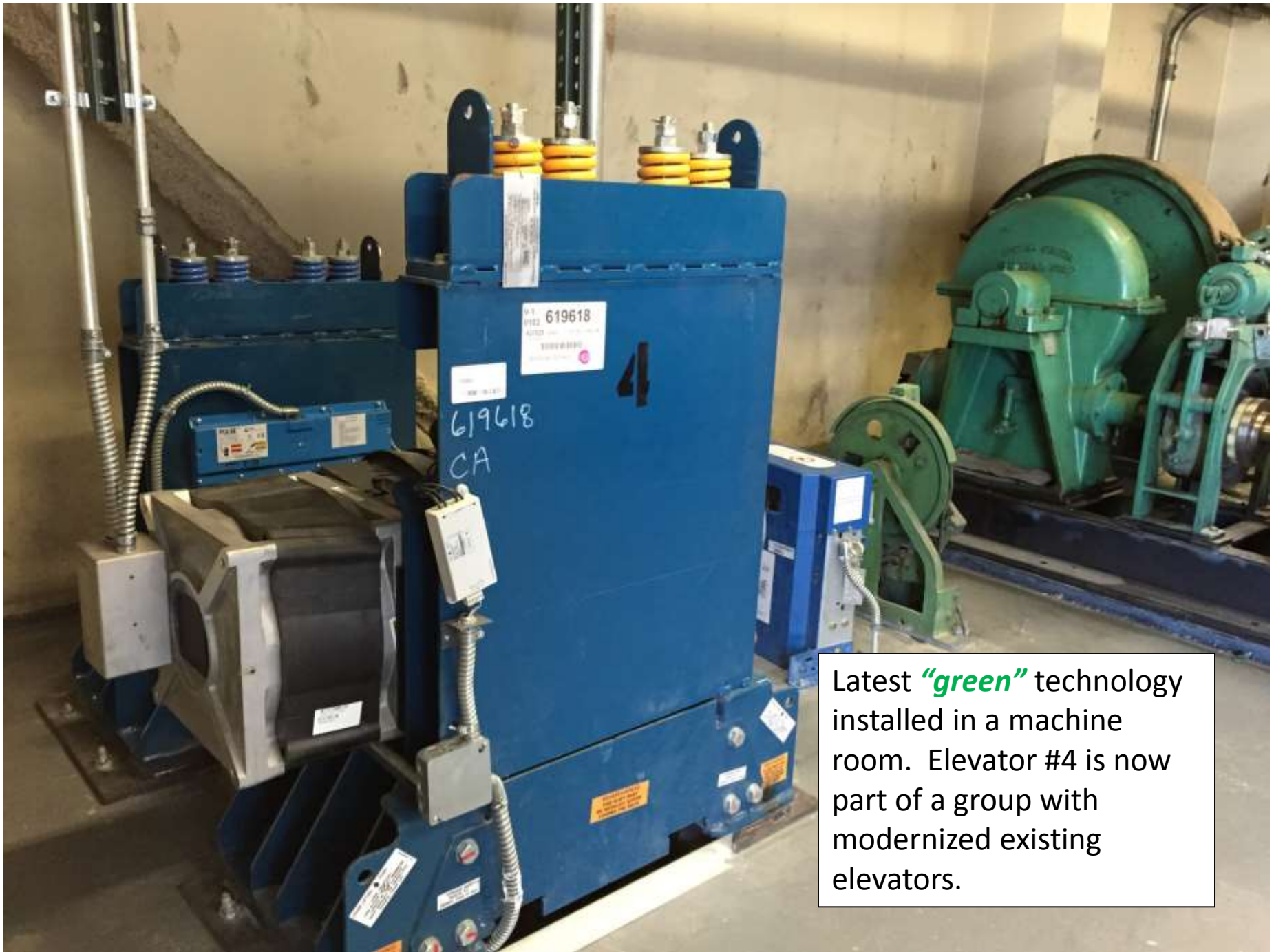
# **The Proposed Title 8 Group V Elevator Safety Orders**

- require **safe elevator designs and installations** that.....
  - protect the elevator worker
  - are accessible and maintainable for the benefit of the riding public, building owners, and building managers.
- **do not prohibit or restrict the use of any energy efficient “green” technology** currently being made available by the elevator industry.



Latest **"green"** technology installed in a machine room. **Energy efficient** permanent magnet a.c. gearless machine, elastomeric-coated steel belts with a 2:1 suspension arrangement.





Latest “green” technology installed in a machine room. Elevator #4 is now part of a group with modernized existing elevators.



Latest **energy efficient** controllers and permanent magnet a.c. gearless machines, with steel wire ropes in a 2:1 suspension arrangement, in a machine room configuration.



Machine room configuration  
for an **energy efficient**  
permanent magnet a.c.  
gearless machine with steel  
wire ropes in a 2:1  
suspension arrangement





# Use of Energy for Cooling and Heating

The current model consensus standard requires that machinery spaces, machine rooms, control spaces, and control rooms to be provided with a natural or mechanical means to keep the ambient air temperature and humidity in the range specified by the elevator equipment manufacturer to ensure safe and normal operation of the elevator.

Regardless of whether elevator equipment is installed in the hoistway or a machine room, the same temperature and humidity controls are required.

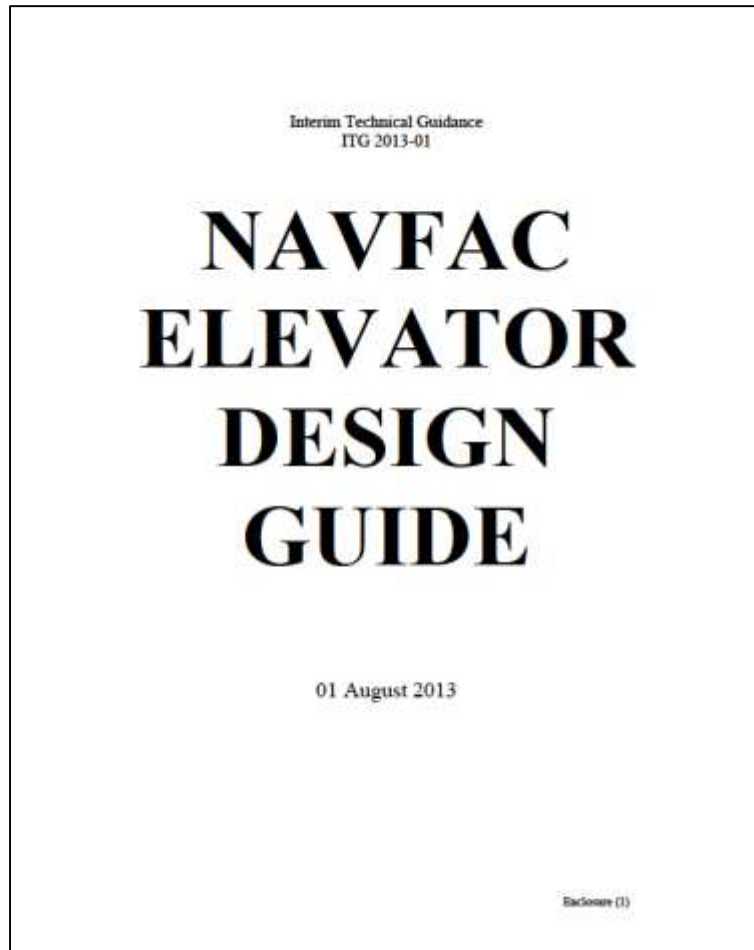


A blower was duct taped to a beam in the overhead to address operational problems with this MRL installation caused by excessive heat in the hoistway.



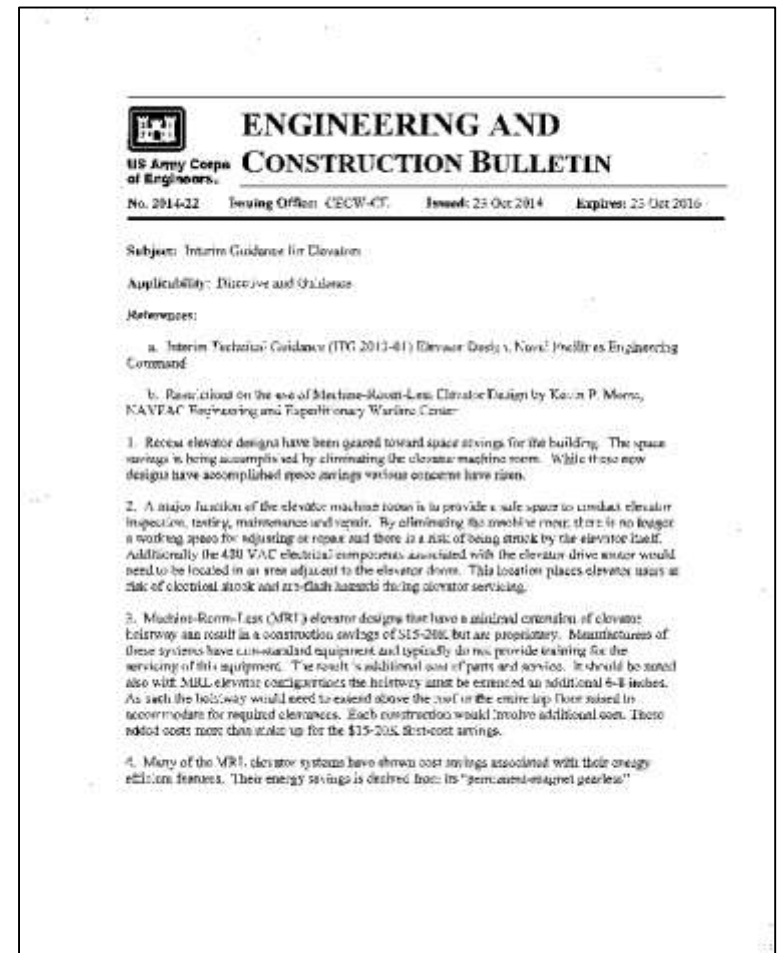
# Other Considerations

The U.S. Navy and Army Corps of Engineers have recognized that many MRL designs lack safe access to equipment. Their recently published elevator design guides prohibit elevator machines and controllers in the hoistway.



[https://www.wbdg.org/ccb/NAVFAC/INTCRIT/fy13\\_01.pdf](https://www.wbdg.org/ccb/NAVFAC/INTCRIT/fy13_01.pdf)

[http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb\\_2014\\_22.pdf](http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2014_22.pdf)



**The proposed Group V Elevator Safety Orders have been criticized because they would allegedly increase costs to building owners by requiring CCCMs instead of “authorized personnel” to perform Firefighters’ Emergency Operation checks.**

The statutes that govern “testing” and “maintaining” elevator equipment are contained in the **California Labor Code**, specifically **§7311.2**. Revising a model consensus standard to allow work by “authorized personnel” does not supersede California law.

When Firefighters’ Emergency Operation is activated, the elevator control is changed from “normal operation” to a complex sub-routine with special functionality. This functionality is designed to protect building occupants, firefighters and emergency personnel during emergencies. Trained and certified CCCMs should routinely “test” Firefighters’ Emergency Operation

The proposed Elevator Safety Orders would reduce the frequency of testing from monthly (as currently required by Group IV Elevator Safety Orders) to quarterly and institute a simplified monthly check that can be performed by authorized personnel in the other months. This proposal, applicable to all elevators in the State of California, provides significant economic relief to building owners and building managers.

## **The proposed Group V Elevator Safety Orders have been criticized because they were allegedly developed without expert input.**

DOSH Elevator Unit personnel have hosted many Advisory Committee Meetings and Subcommittee Meetings with industry experts from all affected stakeholders.

- **12/18/12** - Proposed Group 4.5 Interim Adoption Advisory Committee Meeting
- **2/6/13** - Meeting with elevator company representatives
- **6/26/13** - Subcommittee Meeting with various stakeholders (elevator company representatives, elevator company engineers, elevator consultants, labor representatives) to discuss proposed car top and car top railing clearances
- **4/17/14** - Meeting with elevator company representatives and engineers
- **4/22/14** - Proposed Group V Advisory Committee Meeting
- **7/14/14** - Meeting with building owner and building manager representatives
- **10/9/14** - Meeting with elevator company representatives and engineers
- **2/3/15 and 2/4/15** - Meeting with elevator company representatives and engineers
- **4/9/15 and 4/10/15** - Meeting with elevator company representatives and engineers
- **6/9/15** - Meeting with elevator company representatives and engineers
- **6/10/15** - Meeting with building owner and building manager representatives



**The proposed Group V Elevator Safety Orders have been criticized because they will allegedly eliminate the use of elevators with a capacity of less than 3500 lbs.**

- The proposed Group V Elevator Safety Orders do not prohibit or prevent the use of elevators under 3500 lb. capacity.
- The proposed rules allow the horizontal distance between the car top railing and fixed obstructions in the hoistway to be reduced to 4 inches. This is the same horizontal clearance being considered for the 2016 version of the model consensus standard. Therefore, if a 2500 lb. capacity elevator can be installed in accordance with the proposed model consensus standard, it can likewise be installed under the proposed Group V Elevator Safety Orders.
- The proposed Group V Elevator Safety Orders do include rules that require worker protections from shearing and crushing hazards that were inadvertently introduced by the model consensus standard's requirement to provide car top railings for fall protection. The proposed rules allow for guarding by distance, guarding with screens, and guarding with bevels.
- The proposed rules include provisions for an alternative car top railing design that can accommodate the traditional location of the car top emergency exit. This rule was jointly drafted by elevator company engineers and DOSH Elevator Unit personnel.

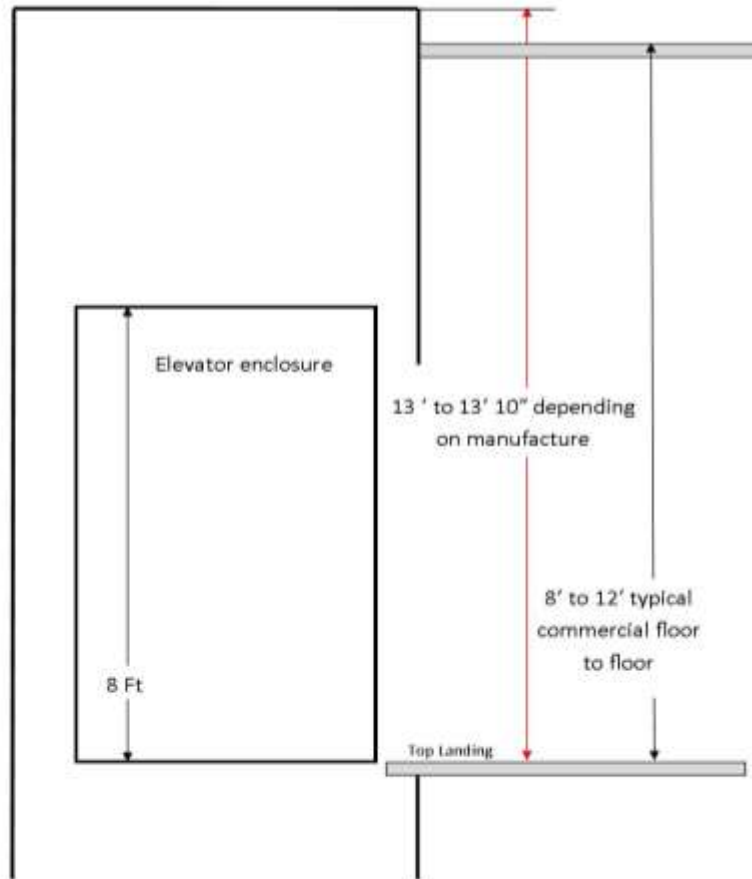
**The proposed Group V Elevator Safety Orders have been criticized because they would allegedly universally enlarge hoistways and reduce rentable space.**

- The proposed Elevator Safety Orders do not “universally” increase the size of the hoistway.
- As shown on the previous slide, the horizontal clearances from the car top railing to fixed and moving obstructions in the hoistway are in line with the proposed 2016 version of the model consensus standard. The proposed Elevator Safety Orders allow for guarding by distance (which can be accomplished by inseting the railing a maximum of 12 horizontal inches), guarding with screens, and guarding with bevels. The elevator designer must choose one of these methods for protecting the elevator worker.
- The proposed Elevator Safety Orders increase the vertical clearance above the car top railing to 12 inches (in lieu of 4 inches) at the extreme limit of travel. This should have little to no affect on rentable space in the building (see the following slide).
- Although not required by the model consensus standard, the proposed Elevator Safety Orders further protect elevator worker safety by requiring a pit ladder that meets the minimum requirements of the General Industry Safety Orders of Cal OSHA and Fed OSHA.
- The rentable space currently taken up by the elevator control space in the building can be re-captured by moving the elevator controller equipment into the elevator machine room for all but MRL configurations.
- DOSH review of industry planning guides indicates that many standard MRL designs already require a larger hoistway footprint in comparison to traditional machine room installations.

**Documents which have been widely circulated by a critic of the proposed Group V Elevator Safety Orders claim that the ESOs.....**

**(Require) “Larger Hoistway/Lost Rentable Space.”**

Even at 150 feet per minute (the slowest operating speed for most MRLs), the typical MRL hoistway will penetrate the floor above, or the roof, making that space un-rentable, regardless of configuration. (Note: Faster speeds require increased vertical clearances.)



**The proposed Group V Elevator Safety Orders have been criticized because they would allegedly force private and public purchasers of conveyances to buy technology that is over 15 years old and would create an additional cost of \$125,000 to \$225,000 per traction elevator.**

- DOSH review of print and on-line elevator marketing material indicates that all of the major manufacturers have standard machine room designs (for example: Otis GeN2™ LUX, KONE EcoSystem MR™, Schindler 5500 MMR) that utilize the same “green” energy efficient technology as their MRL designs in the same or a slightly modified configuration. These standard offerings target the mid-rise elevator market and would almost certainly be suitable for low-rise applications if a standard MRL does not comply with the proposed Elevator Safety Orders.
- To date, DOSH has been presented with **no** documented basis for the assertion that installing essentially identical elevator equipment in a machine room rather than an MRL configuration would equate to the installation of 15 year old technology with an additional cost of \$125,000 to \$225,000 per elevator.
- To the contrary, DOSH estimates that the overall additional building cost for a machine room (vertically extending the hoistway approximately 5 feet, adding a door and a floor), if required, would cost between \$5,000 and \$20,000 per traction elevator. Some or all of the cost for building an elevator machine room would be offset by eliminating the need for constructing a control space in an otherwise rentable portion of the building because the elevator controller would be located in the machine room.



## **The Proposed Title 8 Group V Elevator Safety Orders.....**

- modify the requirements of the current model consensus standard to provide equivalence with the minimum design and installation standards of the Cal OSHA General Industry Safety Orders that apply to all places of employment.
- make elevator equipment accessible and reachable from a non-confined space.
- protect elevator workers from mechanical, electrical, shearing, and crushing hazards.
- protect the general public from inadvertent contact with exposed live parts of elevator controllers in public spaces.

**An elevator installation that is safer and more accessible  
is in the best interest of the elevator worker and the riding public.**